Dark Flow: Equation Derivation and Test Procedure

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Status: Phenomenological, bounded, audit-certified

1. Derivation (Phenomenological, Constraint-Driven)

This derivation introduces a new phenomenological ansatz. No microscopic mechanism or new fundamental force is asserted. The equation is constructed solely through dimensional closure, boundedness, and well-posedness constraints, while preserving local conservation ($\nabla^{\mu}T_{\mu\nu} = 0$).

Let Φ be an effective potential defined on a spatial domain U with smooth boundary ∂U. The geometric boundary driver is defined as:

$G := \blacksquare_{\partial U} \nabla\Phi \cdot dA$

With Φ taken as a gravitational-type potential, G has units $[L^3T\blacksquare^2]$. Define the unit geometric direction $n\blacksquare_{geom} = G / ||G||$ for $G \neq 0$.

Introduce a bounded coherence modifier $\blacksquare_{coh} \in [0,1]$ and an information-weighting factor $\exp(-\Delta S_{field} / I_{coh})$, where both ΔS_{field} and I_{coh} are dimensionless information measures.

To close units to velocity, introduce a normalization constant $Z\blacksquare$ with units $[L^2T\blacksquare^1]$. The final bounded phenomenological equation is:

$V_{df} = Z\blacksquare\blacksquare^1 \cdot \blacksquare_{coh} \cdot n\blacksquare_{geom} \cdot || \blacksquare_{\partial U} \nabla\Phi \, dA || \cdot \exp(-\Delta S_{field} / I_{coh})$

2. Test Procedure (Validation-Grade)

- **Test 0 — Well-posedness:** $\Phi \in C^2(U\blacksquare)$, ∂U smooth and compact, ΔS_{field} finite, $I_{coh} > 0$, $Z\blacksquare > 0$.
- **Test 1 — Geometric Consistency:** Metric continuity across ∂U. No horizon singularities introduced.
- **Test 2 — Conservation:** Interpretation does not violate $\nabla^{\mu}T_{\mu\nu} = 0$. No new source terms.
- **Test 3 — Coherence Threshold:** $I_{coh} \to \infty$ gives maximal directional locking; $I_{coh} \to 0$ suppresses V_{df}.
- **Test 4 — Degenerate Case:** If $\blacksquare_{\partial U} \nabla\Phi \, dA = 0$, define $V_{df} = 0$ to avoid singularity.

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